

STATUS OF TECHNOLOGY

ALASKA NATURAL GAS TRANSPORTATION SYSTEM

A REPORT TO THE ALASKA STATE LEGISLATURE

PREPARED BY

ARCTIC ENVIRONMENTAL INFORMATION AND DATA CENTER

University of Alaska
707 A Street
Anchorage, Alaska 99501

OCTOBER, 1979

ACIDC
: (*49)
Pan: 621.644

POLARPAM
4244

STATUS OF TECHNOLOGY

ALASKA NATURAL GAS TRANSPORTATION SYSTEM

I. INTRODUCTION

- A. Charge from the Legislature: The Legislative Affairs Agency contracted¹ with the Arctic Environmental Information and Data Center (AEIDC) to keep itself, the Joint Gas Pipeline Committee, and the Alaska State Legislature more fully informed on the technology associated with the Alaska Natural Gas Transportation System (ANGTS) and other related matters.
- B. Background: During planning and construction of the trans-Alaska pipeline system (TAPS), many new advances were made in the technology of hot-oil pipeline construction and operation in arctic and subarctic regions. As planning proceeded on a gas line to transport Prudhoe Bay gas to Midwest markets, however, it became evident that many new technological questions would have to be answered before a gas line carrying cold gas could be built and safely operated. A variety of documents^{2,21} point out the need for new technology, cooperative effort, and full utilization of existing technology if the ANGTS is to be planned, constructed, and operated in an efficient, environmentally sound, cost-effective way.

One action proposed was a dialog² to be sponsored by the Polar Research Board of the National Academy of Sciences for the

Rec'd:

Order No.: 12532

Price: \$2.00 U.S.

Acc. No.: A.E.I.D.C.

JUN 17 1980

39961

Department of the Interior (DOI), which was to involve representatives of the governmental, industrial, and academic communities. A paper that identified technical problems associated with construction of ANGTS in Alaska and suggested resolutions to those problems was to be produced and presented to Assistant DOI Secretary Martin. For a variety of reasons the dialog did not take place, and technology has developed at the pace and scope decreed by industry.

We hope that this AEIDC report provides the summary of current knowledge of the progress of technical matters relating to ANGTS that concerned decision makers and interested others require.

- C. Approach: Discussions with Representative Chatterton led to the decision to provide to the Joint Gas Pipeline Committee two preliminary reports and a final summary of findings. Preliminary reports, dated 6 July 1979 and 27 July 1979, were furnished and are a part of this report labeled Reference 4. This document finalizes contract requirements.

II. MAJOR TECHNICAL ISSUES:

- A. Frost heave
- B. Soil liquefaction
- C. Thermal regime

D. Frost bulb/thaw bulb interaction

E. Hydrology

F. Soils

G. Metallurgy

H. Corrosion

III. ADMINISTRATIVE FRAMEWORK

A. Background: The ANGTS is founded in a series of executive^{6,9} and legislative⁷ actions. A new concept of project control was developed for ANGTS, i.e., a federal inspector⁸ (FI) charged with the responsibility of enforcing the terms and conditions of permits and certificates during construction and initial operation of the ANGTS. Also, the president of the United States established an executive policy board to advise the FI.

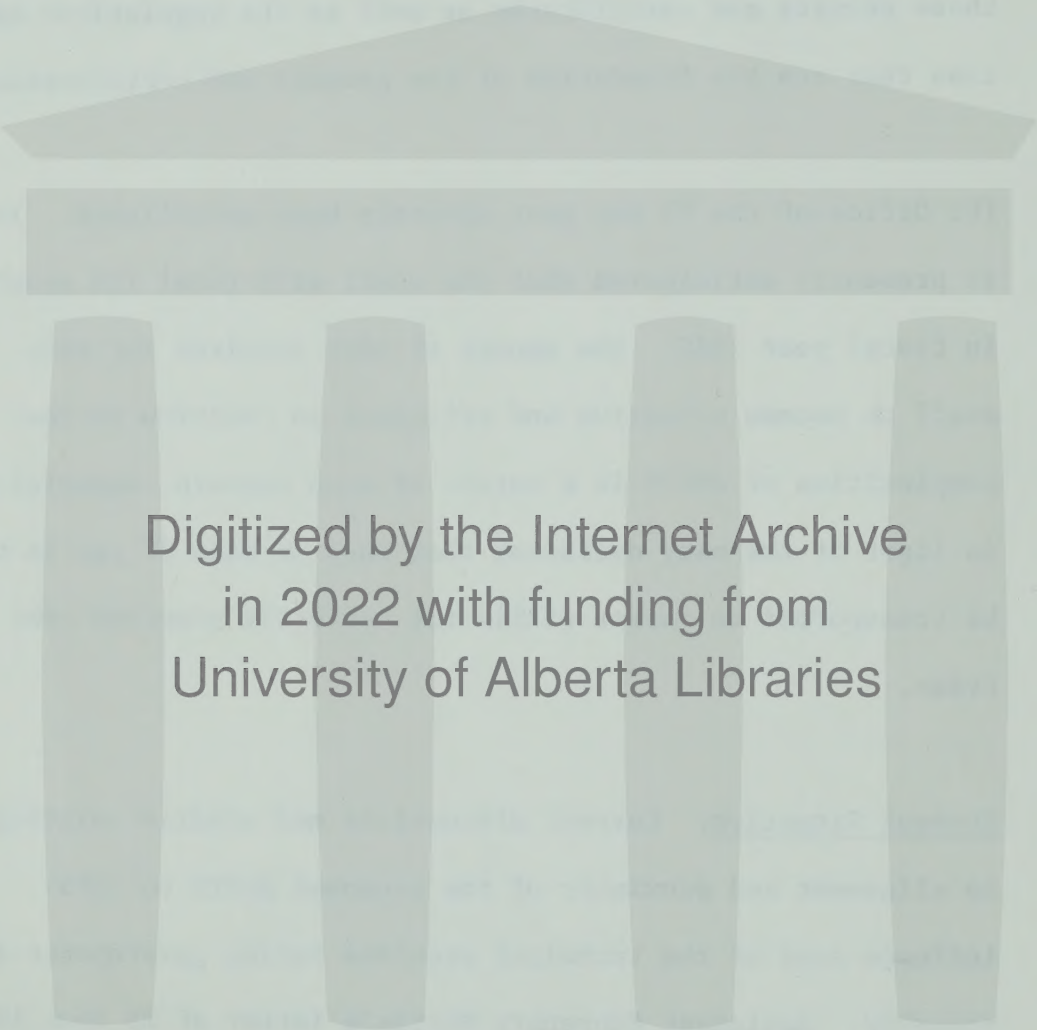
B. Participants: The organization required to build and operate the ANGTS, as directed by the president's decision and other documents, is quite complex and requires intense cooperation by government (federal and state¹⁰), industry, and citizen groups.¹¹

Creation of ANGTS and a federal inspector did not eliminate the authorities of the various departments of government to issue permits and certificates. These remain vested in those departments. The FI will enforce the terms and conditions of those permits and certificates as well as the regulations and laws that are the foundation of the permits and certificates.

The Office of the FI has just recently been established. It is presently anticipated that the staff will total 130 people in fiscal year 1980. The amount of time required for this staff to become effective and efficient in relation to the complexities of ANGTS is a matter of some concern, especially in light of the many decisions that must be made if gas is to be transported to market within the currently proposed time frame.

- C. Present Situation: Current discussions and studies relating to alignment and proximity of the proposed ANGTS to TAPS indicate some of the technical problems facing governments and industry. Assistant Secretary Martin's letter of 13 June 1979 to Al Kuhn of Northwest Alaskan Pipeline Company⁵ (previously furnished to the committee) apparently is the base from which current technology, testing programs, and other activities are being assessed.

The identification of an alignment for ANGTS remains unsettled. Additional technical studies are being initiated by Northwest



Digitized by the Internet Archive
in 2022 with funding from
University of Alberta Libraries

<https://archive.org/details/statusoftechnolo00prep>

Alaskan as a result of DOI's letter of 13 June 1979, but there is no indication of when studies will be completed or what effect they will have on the project. No contingency plans currently exist to determine the course of action to be taken if tests or other documentation requires further modification of design or alignment changes. Northwest Alaskan is also maintaining its position that it will place the pipeline in a buried mode (burial in an elevated berm is an option) for most of the distance of the line. They also state that the gas line, where elevated, will follow the TAPS line precisely except where the ANGTS is planned to parallel the haul road. Little consideration has been given to the potential of construction from a snow pad, which could extend the currently planned construction season as well as provide some flexibility in the construction schedule.

The proximity issue involves all parties and complex technical and environmental considerations^{13,14,15} and directly relates to permitting, enforcement, construction, operations, and the economics of the system as a whole. Cost of the project cannot be determined with any certainty until the proximity question is resolved. Such factors as pipewall thickness, quantities of gravel required, construction schedules, and the question of liability between TAPS and ANGTS must also be resolved.

TAPS owners are on record as fully supportive of ANGTS, but they are adamant that any chance for harm to the TAPS during

construction and operation of the ANGTS must be minimized or completely eliminated. TAPS owners expressed concerns include proximity of the ANGTS to the TAPS as it relates to blasting, modification of the thermal regime, crossing of the lines, modification of hydrologic systems, and other geotechnical and environmental matters. One matter of particular concern is the potential for physical damage to TAPS during construction. It has been suggested that a portable barrier might have to be constructed between TAPS and the construction zone of ANGTS so that the potential for physical damage is reduced.

The foregoing narrative illustrates that Northwest Alaskan is just now beginning to address some of the real problems that must be resolved before they receive approval on final design and begin construction of a 48-inch chilled gas line in an arctic environment. Cost estimates will undoubtedly escalate due to technological considerations.

IV. SUMMARY OF TECHNICAL DECISIONS AND SOLUTIONS MADE THAT AFFECT DESIGN AND CONSTRUCTION

Very few technical decisions and solutions have been entirely resolved. The complexity of the project, as expressed in various memoranda,³ unavoidably leads to this conclusion. Tests involving metallurgy, frost heave, blasting, hydrology, soils, geology, pipe corrosion, and other technical aspects are still being conducted and, in some instances, just getting under way or are being expanded.

Exactly when these tests and studies will be successfully concluded is unknown. Obviously, some will require several years to complete. It can be stated, however, that certain technological aspects of design now appear to be acceptable, e.g., pipe wall thickness for the buried mode and some of the raised sections. However, the amount of pipe of a certain wall thickness needed cannot be determined at this time, and this is one very important consideration in the costing of the project.

The document Outline-Pipeline Design Process¹⁶ became available 10 September 1979 and is the first report of any detail that attempts to answer DOI's concerns as expressed in Enclosure C.⁵ The Outline presents an extremely optimistic viewpoint by Northwest. All issues simply cannot be resolved within present time frames identified for the project. Now that certain data have been acquired from TAPS owners and others, Northwest Alaskan will need to revise its own plans accordingly. This will likely delay project completion and affect project costs, which will be reflected in the Certification Cost and Schedule Estimate¹⁷ (p. 45723).

The status of current research and testing is as follows:

- A. Burst Tests:¹⁶ Testing is currently under way at locations in the United States and England. The consensus of engineers opinion is that the testing program is well designed and the information gathered will be sufficient for design purposes, but since the current testing program utilizes pipe from the TAPS project instead of the pipe that will be used for the ANGTS, additional tests will have to be made using the latter.

B. Blasting Tests:¹⁶ The blasting test program has been generally regarded as excellent. Some criticism has been raised about the limited number of soil types tested, but the results nevertheless appear to be acceptable. Northwest Alaskan proposes that a particle velocity of 8 feet per second be permitted in the majority of the areas where blasting is required. Special protective measures are proposed to be provided at certain locations, such as where the gas and oil lines are close together.

TAPS owners are, however, questioning the validity of certain assumptions drawn from this testing program. They have proposed alternative control criteria where blasting is proposed in proximity to the TAPS. This issue will probably be resolved by DOI in the stipulations it attaches to the right-of-way grant.

C. Frost Heave Testing:¹⁶ Northwest Alaskan has recently acquired soils and related data from the TAPS owners, which it is in the process of evaluating. Other pertinent data are available from the Arctic Gas project, Canadian test sites, Fairbanks test site, and other sources.

Strong feeling has surfaced in certain government and engineering circles that the frost heave testing program is

entirely inadequate and that the information being gathered will not be adequate or available in time for use in the final design process. Many scientists and engineers do not believe that the Fairbanks test site considers enough soil characteristic alternatives to develop design criteria necessary to solve frost heave problems. However, Northwest Alaskan is initiating new on-site frost heave testing. It remains commonly held, however, that the entire frost heave testing program should be upgraded and that it is not being conducted in a timely manner.

Page 37 of the Outline-Pipeline Design Process¹⁶ states that the investigations, testing, and design work will encompass all aspects of the frost heave problem (emphasis added). "All aspects" will probably not be possible within the time frames stated for planning, design, and construction. The information to be developed and the actions to be taken will be extremely time consuming and costly. Objectives are unrealistic and unattainable if this project is to be completed as currently scheduled.

- D. Work Pad Considerations: Northwest Alaskan's recent acquisition of TAPS data includes information relating to the work pad. In addition, Northwest has initiated a drilling program on the TAPS work pad to obtain additional data. Current surveillance reports relating to TAPS indicate that substantial subsidence and erosion are occurring along certain sectors of the work pad, and ANGTS must consider these phenomena

in its own design plans. This activity quite likely will require a joint effort with the TAPS owners.

Northwest Alaskan's general plans relating to the work pad are on page 17 of the Outline.¹⁶ More specifics are being developed and should be available soon.

E. Hydrology: Issues and information to be developed, as provided on page 16 of Outline,¹⁶ appear to be incomplete. Other hydrologic factors need to be considered. Although these factors may be implied in other sections, they should be specifically identified and addressed. One example is the uses of water during planning, construction, and operation and the effect this use will have on the resources within the transportation corridor and other users of the corridor. A corridor management plan is currently being developed by the Alaska State Office of the Bureau of Land Management. This document should provide some insight into future uses of the corridor and its resources.

F. Proximity to TAPS: The Outline¹⁶ is the first document of any consequence from Northwest Alaskan that approaches the proximity question in a comprehensive manner. How the Outline will be completed; the studies, research, and data meshed together; and what effect these actions will have on the scheduling of the project remain unknown. As stated previously, there are deficiencies in the Outline---when, how, or

if these deficiencies will be met is of concern.

As an example, demographic and geographic considerations in relation to the design process are unknown. These are important factors that impact design, scheduling, and construction. The project appears to have been conceived in a vacuum in such respects. Adequate consideration has not been given to all current and projected uses along the route and the impact that these uses will have on the project.

Overall, the strain on the lands, resources, and people of Alaska if the planning, scheduling, and construction of the gas line, conditioning plant, TAPS construction and operation, water flood system, and other major activities are not fully thought out and coordinated could be catastrophic.

G. Risk Analysis: Page 48 Of the Outline¹⁶ is an early attempt by Northwest Alaskan to define the issue of risk analysis, and it appears to be adequate at this time. Again, however, the time required for this process will impact the overall project time frame.

H. Design Pressure: This issue has been resolved by FERC order. A supplement to Docket No. CP78-123 et al. requested a commission order approving design specifications for a 48-inch diameter pipeline with a maximum working pressure of 1,260 psi and initial compression capacity of 2.4 billion cubic feet per day (Bcfd), expandable to 3.2 Bcfd.¹⁹ The State has appealed

this decision, but whether or not this appeal will be successful is unknown.

- I. Corrosion: Research into corrosion of natural gas pipelines by W. M. Sackinger, E. M. Wescott, and W. I. Akasofu is one of the very few new research initiatives under way. It involves the effects of currents induced by the aurora borealis and the correlations of pipeline resistivity with frozen soil and metal corrosion.

Summary: At the 30th Alaska Science Conference,¹⁷ held at Fairbanks, September 19-21, 1979, a series of papers was presented relating the science of building a chilled gas pipeline to factors of the arctic environment. Subject matter ranging from "Geophysical Methods of Detecting Permafrost, Massive Ground Ice and Ice-Rich Soils" to "Distribution and Properties of Road Dust and its Potential Impact on Tundra North of the Brooks Range" was presented.

The science and technology of construction and other facets of energy development in an arctic environment are certainly moving forward. The degree to which Northwest Alaskan is participating with the science and government community in this endeavor, however, appears to be minimal, at best. In light of the technical problems being identified with burying a chilled gas pipeline in an arctic environment, it would seem that Northwest Alaskan should be vitally interested in participating in appropriate scientific

meetings and dialog, particularly since its various test programs are of interest to science and government and will ultimately be judged by both. Recent designation of the FI and his office's involvement with Northwest Alaskan has facilitated identification of problem areas, resolution of those problems, and other topics of mutual concern.

V. SUMMARY OF OTHER ADMINISTRATIVE AND POLITICAL DECISIONS

In Washington D.C. at the present time, actions are being taken by government and industry that will impact the ANGTS in several ways. One significant factor is the FERC order titled Incentive Rate of Return.¹⁸ Representatives of Northwest Alaskan appear to be comfortable with that order and seem ready to increase their efforts to obtain private financing for the project. So far, however, the official scheduled completion date of the project (winter 1984/85) is unchanged. This is unrealistic.

Significantly, three documents are being drafted that may have an impact on the completion date of the project. They are a GAO report on the economics and other matters relating to ANGTS; reimbursement of costs for the permitting process; and industries planning and other documentation relating to the gas conditioning plant. No definite completion date has been announced for when these will be finalized, and their impact on the project completion date is unknown.

The interaction of the FI in the above matters is also an unknown, although it has been precisely stated that the FI is fully dedicated to the effort of seeing the ANGTS completed as quickly and efficiently as possible.

Available information indicates that planning for the ANGTS is fragmented and ill-planned, both by government and industry. Now that the FI has been named and his office established, planning and related activities should improve. However, it will take some time for the FI to hire and orient an informed staff, and many of the actions noted in this paper will probably require resolution before the FI's office becomes effective and efficient. Matters pertaining to cost reimbursement, gas conditioning plant, and the pipeline design process should be thoroughly thought out and addressed in the Joint Federal/State Cooperative Agreement or in other appropriate ways.

The U. S. House of Representatives Committee on Interior and Insular Affairs has scheduled oversight hearings on ANGTS on October 15 and 16. A witness list is not yet available, but hearings will undoubtedly cover management, technical, and economic aspects of the line.

VI. CONCLUDING STATEMENT

Unquestionably, North Slope natural gas is desired for both state and national purposes. The questions are when it will be delivered

and at what cost. Recent technical meetings among the United States, USSR, and Canada revealed that scientists in those countries do not believe that a chilled gas line can be buried except at great cost (engineering and environmental reasons).

The technical design process was initiated when Northwest Alaskan presented its first application to the Federal Power Commission (FPC). The development of the necessary technology for the design and construction of this project has not kept pace with the rhetoric of the statements by Northwest Alaskan that they can complete the project efficiently and in an acceptable way (both technically and environmentally) within the stated time frames. Only recently, Northwest Alaskan has acquired certain data necessary to the project and has contracted with additional consultants and others for the preparation of design and other actions necessary for successful and timely completion. This, coupled with an unknown completion date for the gas conditioning plant and water flood system, makes a date for the first throughput uncertain. Additionally, the United States continues to acquire gas from Canada, an agreement has recently been reached with Mexico on the acquisition of gas, and new domestic gas is being found and made available to consumers in the Lower 48. Some people believe that perhaps Alaska's Prudhoe Bay gas should be saved for future shortages or used for in-state purposes. (There are international aspects to this issue that are beyond the scope of this report.)

It should be clear that the date for throughput in the gas line is

probably at least a year or two or probably more beyond that presently projected by Northwest Alaskan.

Options for in-state use of North Slope natural gas may be available. One option would be to construct a smaller pipeline from the North Slope to some point in interior Alaska or tidewater for industrial, commercial, residential, or other "domestic" uses. This could speed the day when Alaskans first benefit from North Slope natural gas. If this course were followed, however, an entirely new review would be necessary.

All documents referenced in this report are on file at the offices of AEIDC, 707 A Street, Anchorage, Alaska 99501.

REFERENCES

1. Contract between State of Alaska, Legislative Affairs Agency, and Arctic Environmental Information and Data Center, with proposal to the State of Alaska Legislative Affairs Agency, dated June 7, 1979.
2. Summary of Trans-Alaska Oil Pipeline System, Critique Session August 18-19, 1977, U.S. Department of the Interior; Skinnerland Report; Trans-Alaska Pipeline an overview study, Alaska Pipeline Office, U.S. Department of the Interior, September 1977; Various Memoranda of DOI.
3. FPC Proceedings: See, ElPaso Alaska Company, Docket NOS CP75-96, et al., Initial Decision on Proposed Alaska Natural Gas Transportation Systems, February 1, 1977
4. Interim Reports, dated July 6 and July 27, 1979, to the Legislative Affairs Agency, Joint Gas Pipeline Committee.
5. Letter from Guy Martin, Department of the Interior, to Edwin Kuhn, Northwest Alaskan Pipeline Company, with enclosures, June 13, 1979.
6. Decision and Report to Congress on the Alaska Natural Gas Transportation System, September 1977.
7. The Alaska Natural Gas Transportation Act, Public Law 94-586
8. Reorganization Plan No. 1, April 2, 1979 (establishes the Office of the Federal Inspector).
9. Executive Order, 2142, June 21, 1979 (establishes the Executive Policy Board)
10. Draft of Joint Federal/State Cooperative Agreement.
11. Draft Citizens Committee Charter.
12. Federal Inspector's Budget Request for fiscal years 1979 and 1980.

13. Summary of Working Group Assumptions and Conclusions.
14. Evaluation of Alternative NAPLINE and DOI Proposed Routings.
15. Surveillance Report, prepared by the Alaska Department of Fish and Game.
16. Preliminary Outline Pipeline Design Process.
17. Abstracts of the 30th Alaska Science Conference, September 19-21, 1979, Fairbanks, Alaska.
18. FERC Order No. 31, dated August 3, 1979.
19. Prudhoe Bay Project, Draft Environmental Impact Statement, FERC/EIS 009D, July, 1979.
20. Determination of Incentive Rate of Return, Tariff, and Related Issues, June 8, 1979 44FR 45681.
21. Alaskan Arctic Gas Study Company, Shelf List (various materials located at and owned by AEIDC) September 27, 1977.

[illegible]

Pam:621.644.
(*49)
AEIDC

AUTHOR	and Data
TITLE	Status of technology: Alaska Natural Gas Transportation System.

[illegible]

University of Alberta Library



0 1620 0335 6894